

Department of the Interior  
U.S. Geological Survey

# **LANDSAT 5 (L5) THEMATIC MAPPER (TM) DATA VALIDATION AND EXCHANGE (DV&E) IMPLEMENTATION PLAN**

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# LANDSAT 5 (L5) THEMATIC MAPPER (TM) DATA VALIDATION AND EXCHANGE (DV&E) IMPLEMENTATION PLAN

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## **Executive Summary**

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This Landsat 5 (L5) Thematic Mapper (TM) Data Validation and Exchange (DV&E) Implementation Plan provides the U.S. Geological Survey (USGS) and the International Cooperators (ICs) with a reference document to assist in the validation and exchange of L5 image data.

This document is under the control of the Landsat Configuration Control Board (LCCB). Submit Landsat Configuration Change Requests (LCCR) related to this document, as well as supportive material justifying the proposed changes, to the Mission Management Office (MMO) at the USGS Center for Earth Resources Observation and Science (EROS) in Sioux Falls, South Dakota.

## Document Change Summary

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# Section 1 Introduction

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## 1.1 Purpose and Scope

This document is intended to supplement Memorandums of Understanding (MOU) between the United States Geological Survey (USGS) and the International Cooperator (IC). For Landsat 5, these MOUs were originally established with the National Oceanic and Atmospheric Administration (NOAA) and transferred to the USGS through an Exchange of Letters. It should be noted that these MOUs were written by another Agency for a prior mission. Since then USGS has taken management responsibility for the Landsat Program and has established new MOUs for the Landsat 7 mission. Items related to data exchange for Landsat 7 are assumed for the purposes of this document to also apply to Landsat 5.

This Data Validation and Exchange (DV&E) Implementation Plan defines the conditions and procedures used to validate the interchangeability and comparable quality of Landsat 5 (L5) Raw Computer Compatible (RCC) data acquired by the Landsat International Ground Stations (IGSs). This document also defines and describes the procedures used to exchange L5 data downlinked to International Ground Stations (IGSs) in support of U.S. Geological Survey (USGS) archive population. This document does not address the conditions, procedures, and criteria for Level 1 product producers seeking USGS validation of their processing systems.

## 1.2 Overview and Background

As a result of the Landsat 7 (L7) Scan Line Corrector (SLC) Anomaly in May 2003, a number of ICs have established or resumed L5 TM direct downlink acquisitions in order to supplement their Landsat data archives. While the IC represents the responsible organization, each IC may operate one or more individual International Ground Stations (IGSs). The IGS is the entity responsible for receiving the direct downlink image data from the L5 satellite and interacting with the USGS for the data validation and exchange activities described in this document.

This document describes the L5 IGS data quality validation process, and also outlines the procedures that the IGS and the USGS follow when an IGS provides L5 TM data to the USGS/Earth Resources Observation and Science (EROS) for population of the USGS Landsat archive. These requirements are in addition to those specified for IGS reception of L5 data as detailed in the International Ground Station ICD (LS-ICD-41).

The reason for inter-station data format and quality validation of RCC and L0Rp products generated by the USGS and the ICs is to ensure archive compatibility in the case data exchange is required.

The reasons for data exchange are to provide data for:

- Product validation
- Key government programs

- Significant loss of L5 spacecraft capability
- Short-term loss of IC reception capability

### **1.3 Goals and Objectives**

The goals and objectives of the DV&E Implementation Plan are as follows:

1. Describe the procedures used to validate that the approved data exchange format (RCC) is interchangeable and generated per the appropriate Data Format Control Book (DFCB).
2. Define a data exchange procedure for key government programs, of either a US or IC agency, to acquire data from a ground station's archive in support of scientific research or disaster response.

### **1.4 Data Policy**

Data acquired under this plan are used to populate the USGS Landsat archive at EROS for redistribution. Data provided to the IC (or IGS representing the IC) in support of a key government program are subject to the data policy of the IC, unless negotiated between the USGS, the key government program, and the IC.

## **Section 2    Product Validation**

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### **2.1    Definition**

Data quality validation consists of verifying the RCC data generated by an IGS (operated by an IC) in order to assess compliance with the appropriate DFCB and product specifications such as media and format requirements. The USGS Landsat Project is responsible for monitoring L5 data quality. Data exchange for quality validation purposes refers to transfers to the USGS from an IGS, and also transfers to an IGS from the USGS.

### **2.2    Data Requirements**

Each IGS operated by an IC is asked twice each year to provide RCC data to the USGS for validation purposes. Each IGS maintains a single Point-Of-Contact (POC) who serves as the primary interface for communications with the USGS POC regarding all data quality validation activities. The USGS specifies the path, row, acquisition date, and IGS orbit number of the data required for validation.

RCC data are to be delivered as full interval data written to a single media in accordance with the L5 RCC DFCB (LS-DFCB-06). If electronic transfer is used, the USGS may request that the data are provided via File Transfer Protocol (FTP) push by the IGS to a specified USGS FTP location.

Revalidation for each IGS occurs on a biannual basis after the USGS has been able to extract, ingest, and process RCC data from that IGS.

### **2.3    Validation Activity Overview**

For L5 validation, image data captured via direct downlink to the IGS are sent to the USGS for extraction, ingest, processing, and verification against the L5 RCC DFCB (LS-DFCB-06).

Ground stations providing RCC data for validation purposes copy the L5 image data to one of the required media in accordance with the L5 RCC DFCB (LS-DFCB-06) and ship them to the USGS along with all supplementary information. Upon arrival at the USGS, the IGS RCC image data are extracted, checked for compliance to the L5 TM RCC DFCB, ingested for inventory processing, archived, and a Level 0R Distribution Product (L0Rp) is generated. The L0Rp data are then ingested and processed to a **Level 1 Geometrically Corrected (L1G)** product, in order to verify that the IGS RCC may be processed end-to-end by USGS systems and are of good quality.

### **2.4    Supplementary Information**

Supplementary information is required for success of the data quality validation exercise. Each IGS shall include this documentation with all validation data sent to the USGS. The specific information required by the USGS includes: path, row(s), acquisition date, interval start/stop times, ground station identification, and the method used to write the data to media (e.g., block size, tar).

## **2.5 Media and Format Requirements**

Each IGS shall provide RCC data in accordance with the media and formats described in the L5 TM RCC DFCB (LS-DFCB-06).

Hardcopy documentation of the data contents is required for all physical media transferred to and from the USGS (described in 2.4). Softcopy documentation of the data contents is required for all electronic media transferred to and from the USGS (described in 2.4).

## **2.6 Data Delivery Requirements**

To ensure a timely completion of the validation procedures, a two-week turn-around time is required from receipt of the validation data request at the IGS to the delivery of the RCC data and/or L0Rp products at the USGS. The IGS is responsible for placing orders and addressing any logistical issues related to the fulfillment of the USGS data request.

## **2.7 Scheduling and Frequency**

Each IGS is scheduled to provide validation data to the USGS twice per year. Similarly, an IGS may request validation data from the USGS once per year. Additional data sets may be provided upon request, with Landsat Project Manager approval.

## **2.8 USGS Validation Procedures**

### **2.8.1 Raw Computer Compatible (RCC) Data**

The objectives of the RCC data validation procedures include the following:

1. Verifying conformance to the L5 TM RCC DFCB (LS-DFCB-06), thus ensuring that RCC data provided by multiple stations are readable using standard ingest routines.
2. Verifying that the USGS systems can ingest, archive, and process RCC data provided by an IGS to generate an L0Rp product.
3. Verifying that the USGS processing systems can ingest an L0Rp product resulting from the IGS RCC data and process it to an L1G product.

An overview of the RCC data validation procedure is as follows:

1. The RCC interval data are ingested for inventory processing and entry into the USGS archive (as validation data).
2. An L0Rp product generates from the USGS archive copy.
3. Metadata information from the L0Rp product is compared against the supplementary information provided by the IGS.
4. After the L0Rp product is determined to be of good quality, the scene is ingested and processed by a USGS Level 1 processing system for generation of an L1G product.

5. After the L1G product is determined to be of good quality, the IGS data validation exercise is considered successful.

## **2.9 Documentation of Validation Results**

The USGS documents the results of the L5 data quality validation to the IGS after each validation exercise. Validation results are also distributed on a yearly basis to members of the Landsat Technical Working Group (LTWG) and/or participants of the Landsat Ground Station Operations Working Group (LGSOWG). A summary of each station's performance may be made available to the public with the consent of the IGS.

## **2.10 Waiver of Validation Requirements**

Once each individual IGS has been successfully validated, a waiver of validation requirements may be allowed for cases where the IC can demonstrate, by analysis and example, that the data from a single station are representative of the performance of all administered stations. This waiver allows the IC to potentially provide a single data set that can be used for validation of all administered stations.

## **2.11 Data Validation by the IGS**

Each IGS receives one RCC data set with supplementary information from the USGS once per year. An LORp product corresponding to a single scene within the RCC data set may also be provided to the IGS, upon request by the IGS. Additional validation data may also be provided to the IGS upon request, with Landsat Project Manager approval.

Each IGS is responsible for creating and maintaining their methods and procedures throughout the IGS data validation exercise.

When the USGS provides data to an IGS for validation purposes, the IGS is requested to provide a detailed summary of the data validation results to the USGS within 60 days after IGS receipt of the data. Disclosure of the information in this summary is limited to the USGS and National Aeronautics and Space Administration / Landsat Project Science Office. Further distribution requires USGS approval.

## **Section 3    Key Government Programs**

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### **3.1    Definition**

A key government program (USGS or IC) is one that requires L5 data for scientific research or emergency disaster relief applications. A government agency or government organization must administer a key government program.

Administration of a key government program consists of either a direct activity of a government agency or organization, a subcontracted activity directly managed by a government agency or organization, and/or an activity funded directly by a government agency or organization.

Data exchange for an IC key government program is limited to data currently residing in the USGS L5 archive and visible through the publicly accessible USGS search and order systems.

### **3.2    Authorization Requirements**

#### **3.2.1    USGS Authorization**

The USGS Landsat Project Manager or designee authorizes the use of L5 data exchange for key government programs. This person is also responsible for tracking usage of this provision to ensure that data volume limitations are maintained. The Landsat Project Manager may increase the number of scenes provided to an IGS as part of a key government program.

The Landsat Project Manager serves as the final authority in resolving disputes regarding the use of this data exchange provision for key government programs.

#### **3.2.2    International Cooperator Authorization**

Each IC has a designee serving as the certifying authority for IC requests for key government program status. All data requests for an IGS key government program must go through the IC designee. This person serves as the single POC between requesting programs and the USGS Landsat Project, and is responsible for tracking requests to ensure that the specified data volume limitations are maintained.

### **3.3    Data Request Procedures**

The USGS is permitted to request up to 300 scenes per year from each IC. Each IC may also request up to 300 scenes per year from the USGS L5 archive. Allowable scenes are limited to those that fall within the IC's station reception footprint area(s).

Each station, including the USGS, defines the procedures for submitting data requests in support of key government programs. Provisions are made if necessary to place high-priority, rapid turnaround orders for emergency/disaster response activities.

The IC designee acts as a single point of contact when requesting data from the USGS using this data exchange provision. The USGS Landsat Mission Management Officer acts as a single point of contact for receiving and initiating the fulfillment of any data requests from ICs using this provision.

### **3.4 Data Delivery Requirements**

Data delivery requirements for IC government programs are negotiated on a case-by-case basis to the mutual agreement of the IC, USGS, and key government program.

Turnaround time for delivery of standard L5 data requests may vary from three days to three weeks, depending on the level of processing required, media type, and method of delivery. Time-critical emergency and/or disaster response orders are to be handled through established User Services procedures and protocols for high-priority order submissions and acquisition requests.

### **3.5 Data Archive and Distribution Rights**

Data provided to the IC as part of a key government program are subject to the data policy of the local station unless otherwise negotiated between the USGS, the key government program, and the IC. Data that the USGS receives from an IC for key government programs are subject to the data policy of the USGS for archiving and distributing the data and subsequently produced data products.

## **Section 4    Significant Loss of L5 Spacecraft Capability**

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### **4.1    Definition**

Data exchange for loss of spacecraft capabilities is invoked in response to a temporary or sustained loss of spacecraft capability.

This data exchange is one-way, from an IC to the USGS. Due to the uncertainties in evaluating spacecraft anomalies and the high priority associated with addressing spacecraft issues, the USGS may request data to be exchanged retroactively from a station's historical archive.

### **4.2    Authorization Requirements**

The USGS Mission Management Officer is the determining authority for implementing a data exchange based on a temporary or permanent loss of system capabilities. Permanent loss of the L5 TM instrument capability may necessitate renegotiations between the USGS and the IGS regarding per-scene costs and/or station access fees.

### **4.3    Data Transfer Requirements and USGS Support**

Data are requested based on path, row, and acquisition date. Data are to be delivered in RCC format, in conformance with the L5 TM RCC DFCB (LS-DFCB-06). Data transfers will be arranged individually with each IGS, based on station capabilities.

The USGS may opt to provide specialized data-capture equipment to a site for data collection. Arrangements for installation and operation of this specialized data-capture equipment are negotiated between the USGS and the IC.

### **4.4    Data Delivery Requirements**

Data delivery turnaround time is 30 or fewer days from the time a data request is submitted to an IC to the date of delivery to the USGS.

### **4.5    Data Archive and Distribution Rights**

The USGS will archive, distribute, and generate products and re-distribute the exchanged data in accordance with U.S. Data Policy, unless negotiated between the USGS and the IC. The USGS will distribute IGS-acquired data to the public no earlier than 30 days from the date of transfer to the USGS, unless the requested data are for a key government program.

## **Section 5    Short-term Loss of IC Reception Capability**

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### **5.1    Definition**

One-way data transfers to an IC are authorized to address problems (or anticipated problems) with L5 data reception, such as short-term loss of reception capability due to station outages, or scheduled maintenance or hardware failures.

### **5.2    Authorization Requirements**

#### **5.2.1    USGS Authorization**

The USGS Landsat Project Manager or designee gives authorization to use this provision and determines if the requesting IC meets the criteria set forth in this provision for data exchange.

The USGS Landsat Project Manager is responsible for tracking usage of this provision to ensure data volume limitations are maintained. The USGS Landsat Project Manager may increase the number of scenes provided to an IC.

The USGS Landsat Project Manager serves as the final authority in resolving disputes related to the applications of this document.

#### **5.2.2    International Cooperator Authorization**

The IC designee serves as the certifying authority for IC requests for data. The IC designee is also responsible for tracking requests to ensure that the specified data volume limitations are maintained.

### **5.3    Data Availability**

Each IC may request up to 300 scenes per year from the USGS L5 archive using the publicly accessible USGS search and order systems. Allowable scenes are limited to those that fall within the IC station reception footprint area(s).

## **Section 6     Funding Mechanisms**

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### **6.1     Product Validation**

Data exchanged between the USGS and IC for data validation are provided without any exchange of funds or other compensation. The party generating the data is also responsible for funding the shipment of the data to the requesting party.

### **6.2     Key Government Programs**

Several payment mechanisms may be used based upon agreement between the USGS and the IC. They include quid pro quo, data in lieu of data access fees, or any method of payment agreed to by the parties. In general, the cost-of-reproduction model is used as a basis for calculating per-scene costs, or a price negotiated between the USGS and the IC.

#### **6.2.1     Quid Pro Quo**

Upon mutual agreement of the station and the USGS, data exchange costs may be handled on a quid pro quo basis, whereby an equivalent number of scenes or an equivalent amount of and type of data are exchanged between the station and the USGS. In this case, both the station and the USGS cover their respective costs associated with ordering, data production, and shipping between the station and a designated USGS representative.

#### **6.2.2     Adjustments of the Data Access Fees**

At the discretion of the Landsat Project Manager and upon mutual agreement of the station and the USGS, the equivalent value of provided scenes may be counted against the payment of station data access fees.

### **6.3     Significant Loss of L5 Spacecraft Capability**

For temporary losses of spacecraft capability, the USGS may request data from the IC and pay for such data by reducing the value of the exchanged data from the data access fees.

For a permanent loss of spacecraft capability, in which the USGS becomes dependent upon ground stations to populate the U.S. archive, the USGS may renegotiate with individual ICs for required data acquisition services.

### **6.4     Short-term Loss of IC Reception Capability**

Several payment mechanisms may be used based upon agreement between the USGS and the IC. They include quid pro quo, adjustments to data access fees, or other methods of payment agreed to by the parties.

#### **6.4.1     Quid Pro Quo**

Upon mutual agreement of the station and the USGS, data exchange costs may be handled on a quid pro quo basis, whereby an equivalent number of scenes are exchanged between the station and the USGS. In this case, both the station and the

USGS cover their respective costs associated with ordering, data production, and shipping between the station and a designated USGS representative.

#### **6.4.2 Adjustments to Data Access Fees**

At the discretion of the Landsat Project Manager and upon mutual agreement of the station and the USGS, the equivalent value of the requested scenes may be added to the schedule of station data access fees. In general, the standard USGS pricing model is used as a basis for calculating per-scene costs.

## **Section 7    Plan Implementation**

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### **7.1    Effective Date**

The terms, conditions, and procedures of this plan are in effect as of the signatory dates on this document.

### **7.2    Data Validation Schedule**

The activities of IGS data validation are ongoing, as of the signatory dates on this document.

### **7.3    Contingency Plan for Loss of Landsat Spacecraft Capability**

USGS prepares a detailed Contingency Plan to address the technical and programmatic issues involved in collaborating with an IC to acquire L5 data to populate the USGS archive.

## References

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Please see <http://landsat.usgs.gov/resources/acronyms.php> for a list of acronyms.

USGS/EROS. LS-DFCB-06. Landsat Thematic Mapper (TM) Raw Computer Compatible (RCC) Data Format Control Book (DFCB). Version 1. November 2003.

USGS/EROS. LS-ICD-41. Landsat 5 (L5) International Ground Stations (IGS) Interface Control Document (ICD). Version 6.0. October 2005.